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ASSESSING ALMOND'S FLOWERING PHENOLOGY USING MULTI-SPECTRAL SATELLITE IMAGERY

Abstract

Recent climate shifts significantly reduced major crops' yield worldwide and challenged our understanding of the physiology of deciduous trees during dormancy, which is highly affected by warmer winters. Adapting to climatic changes requires making rapid decisions regarding crops and accelerating related studies. Therefore, we need to enhance the ability to monitor tree crops on a large scale continuously. In this regard, earth-observing missions are greatly helpful for such monitoring. We aimed to develop an approach for monitoring the flowering phenology of almonds using remote sensing applications in California. These were used to validate the eco-physiology model of the carbohydrate-temperature model (C-T model). To do so, we used multi-spectral satellite images to create time series of vegetation and flowering indices of EBI and NDVI. Then, we develop a method for monitoring the flowering dynamics of almond orchards and detecting the peak of the flowering in each almond orchard using time series analysis of these spectral indices. To evaluate our method, we placed time-lapse cameras in several sites across California. Our results show we were able to correctly detect the peak of the bloom at all the camera sites across California with no ground truth data needed. Furthermore, we were able to create maps of the almond flowering progression across California. With the method we developed, we could validate the C-T model that identifies a metabolic relationship between weather temperature, carbohydrates in dormant trees, and their blooming time. Due to the warm climate and the spread of almond orchards across a climate gradient in California, we can evaluate the effects of climate change on bloom patterns across a wide range of landscapes and support long-term and short-term decisions regarding different deciduous tree crops.